INTI
International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	**April 2019**
Programme	:	Diploma in Electrical and Electronic Engineering (DEEI)
Course	:	**MAT 1135: Engineering Mathematics 2**
Date of Examination	:	28 July 2019 (Sunday)
Time	:	11:00am – 1:00pm Reading Time : Nil
Duration	:	2 Hours
Special Instructions	:	

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-programmable calculator

Materials provided :

Formula Booklet 1

Examiner(s)	:	**Chan Ah Wah**
Moderator	:	Dr. Ch'ng Pei Eng

This paper consists of *4* printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEE/I)
MAT1135 ENGINEERING MATHEMATICS 2

FINAL EXAM : APRIL 2019 SESSION

Instructions

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) If $z_1 = 1 + i$ and $z_2 = 2 - 3i$, compute the following and leave your answers in cartesian form.

(i) $3z_1 - 4z_2$

[2 marks]

(ii) $z_1 z_2$

[3 marks]

(iii) $\dfrac{z_1}{z_1 + z_2}$

[5 marks]

(b) Given $z = \sqrt{3} + i$.

(i) Express z in polar form with argument in degrees.

[4 marks]

(ii) Find the two square roots of z. Leave your answers in polar form.

[6 marks]

(c) Use De Moivre's Theorem to express $\left(\dfrac{1}{2} - \dfrac{1}{2}i\right)^8$ in the form of $a + ib$.

[5 marks]

Question 2

(a) Solve the following by the indicated substitutions:

(i) $\displaystyle\int \frac{\sec^2 x}{\sqrt{1 - \tan^2 x}}\, dx; \quad u = \tan x$

[4 marks]

(ii) $\displaystyle\int \frac{\ln x}{x}\, dx; \quad u = \ln x$

[4 marks]

(iii) $\displaystyle\int \frac{x + 1}{\sqrt{x^2 + 2x + 3}}\, dx; \quad u = x^2 + 2x + 3$

[4 marks]

(b) Solve the following by any method deemed appropriate:

(i) $\int x \sin^2 x \, dx$

[6 marks]

(ii) $\int \frac{dx}{x^3 + 9x}$

[7 marks]

Question 3

(a) Given $z = e^{x+y} \sin\left(x^2 y^3\right)$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.

[6 marks]

(b) Given the expression $G = \frac{AL}{M^4}$ where A is a constant. If errors of $\pm 0.25\%$ and $\pm 1\%$ are possible in measuring L and M respectively, determine the maximum percentage error in the calculated value of G.

[3 marks]

(c) Use Euler's method to solve for the values of y for $x = 0.0(0.1)0.4$ if

$$\frac{dy}{dx} = y^2(1+2x), \quad y(0) = 1.$$

Let all workings be correct to **four (4)** decimal places. Formula for Euler's method:

$$\frac{dy}{dx} = f(x,y)$$

$$x_{n+1} = x_n + h$$

$$y_{n+1} = y_n + hf(x_n, y_n)$$

[4 marks]

(d) Use the series

$$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$$

to expand $\ln\left(\frac{1-2x}{1+2x}\right)$ as a series of ascending powers of x up to and including the term in x^5.

[6 marks]

(e) (i) Derive the binomial series for $(1+x^2)^{-1}$ up to and including the fourth term.

[2 marks]

(ii) Use the result in (i) to evaluate the integral

$$\int_0^{0.4} \frac{x}{1+x^2} \, dx$$

Let your answer be correct to **four (4)** decimal places.

[4 marks]

Question 4

(a) The power P dissipated in a resistor is given by $P = \frac{E^2}{R}$. If $E = 220V$ and $R = 5\Omega$, find the change in P resulting from a drop of 5V in E and an increase in 0.2Ω in R.

[5 marks]

(b) Solve the following differential equations:

(i) $(1+x^2)\frac{dy}{dx} + 3xy = 5x$ [6 marks]

(ii) $\frac{dy}{dx} + (\tan x)\, y = \sin x$ [5 marks]

(iii) $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 2x^2$ [9 marks]

Question 5

(a) Use Laplace transfom to solve the following differential equation:

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = \sin 2t$$

given that $y(0) = 0$ and $y'(0) = 0$. [10 marks]

(b) The probability that a person having an accident in a certain period of time is 0.0003. For a population of 7500 people in a small town, determine the probability of less than 3 people having an accident during this period.

[5 marks]

(c) The life time of a certain brand of car battery is normally distributed with mean time of 400 days and standard deviation of 35 days. For a sample of 50 new batteries, determine how many will last between 350 and 450 days.

[5 marks]

(d) Given in the table below is a set of raw data.

Class Intervals	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44
Frequency	4	8	14	22	19	10	3

Compute, with appropriate workings, the

(i) mean, [2 marks]

(ii) standard deviation. [3 marks]

End of Paper

<MAT1135(F)/APR2019/CHANAW>